REMARKS

This is in response to an Office action dated 9/13/94. A fee for a TWO month's extension of time in which to respond is enclosed herewith, and the extension is requested.

In the Office action:

- claims 29, 33, 34, 36-38 are withdrawn from consideration;
- claims 15 and 16 are allowed;
- claims 1-14, 17-21, 22-24, 26, 32, 35 are rejected; and
- claims 25, 27, 28 30, 31 are objected to.

The drawings are objected to as having improper margins and reference characters of insufficient height.

Formal drawings addressing the drawing objections will be submitted in due course.

NON-SUBSTANTIVE MATTERS

A. (See paragraph 1 of the Office action) Claims 29, 33, 34, 36-38, withdrawn from consideration, have not been treated on the merits. It is noted that even if claim 38 were in proper form, it would be subject to restriction.

Claims 29, 34, 36 and 37 are amended herewith to be in single (versus multiple) dependent form. Claims 33 and 38 are cancelled herewith.

B. (See paragraph 2 of the Office action) Claims 14, 17-23, 26 and 35 are rejected under 35 USC §112, second paragraph, as being indefinite. Particulars are set forth with regard to claim 14 only, wherein in claim 14, line 11, it is not clear which "stem" is being referred to, and "stem" has been treated as "stems".

Claim 14 is amended herewith to clarify that a **wire** is bonded to a **terminal**, and is formed into a **stem**. The stem has a "first stem end" which is the bonded feed end of the wire. Without severing the wire, intermediate portions of the wire are sequentially bonded, forming "protruding stem segments" between each pair of bonds. After the final bond is made, the wire is severed. Attention is directed to **Figure 17** of the specification.

Claim 17 is amended herewith to be in single (versus multiple) dependent form, to clarify antecedent basis for the limitations of the claim. Moreover, claim 17 is amended herewith to depend from claim 15 (allowed).

Claims 18-23 and 26 are amended herewith to depend directly from claim 15 (allowed), rather than from multiple dependent claim (as filed) 17, which should also clarify antecedent basis for the limitations of these claims.

Claim 35 is amended herewith to be in single (versus multiple) dependent form, and (as amended) depends from claim 14 (amended herewith to overcome the 112/2 rejection, inter alia).

C. The rejection under paragraphs 3 and 4 of the office action (103 rejection of particular claims) is discussed hereinbelow (SUBSTANTIVE GROUNDS OF REJECTION).

D. (See paragraph 5 of the Office action) Claims 25, 27, 28, 30, 31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

Claims 25, 27, 28, 30 and 31 are amended herewith, in accordance with this grounds of objection, and should be allowed.

E. (See paragraph 6 of the Office action) Claims 21, 26 and 35 would be allowable if rewritten to overcome the rejection under

35 USC 112, second paragraph, and to include all of the limitations of the base claim and any intervening claims.

Claims 21, 26 and 35 are amended herewith, and should be allowed.

F. (See paragraph 7 of the Office action) Claims 15 and 16 are allowable over the prior art, of record.

Inasmuch as these claims (15 and 16) are allowable over the prior art of record, they are not amended herewith, and should be allowed.

SUBSTANTIVE GROUNDS OF REJECTION

G. (See paragraphs 3 and 4 of the Office action) Claims 1-14, 17-20, 22-24, 32 are rejected under 35 USC §103 as being unpatentable over Kobayashi, et al. (4,821,148) in view of Christy, et al. (3,460,238).

Brief Summary of the Invention:

The present invention relates to methods of manufacturing protruding (protuberant), controlled (e.g., enhanced) aspect ratio, shaped contacts for use with "electronic components" which include semiconductor devices, interconnection substrates, test sockets, and the like.

Generally, the protuberant contacts are made by bonding a free end of a wire to a terminal (or the like) on an electronic component (using, e.g., wirebonding equipment), shaping the wire into a "wire stem", then providing the wire stem(s) with a coating (of one or more layers) that envelops or jackets the skeletons and the terminals. The coating (which may be a multi-layer coating) provides two significant advantages (See, e.g., Specification at page 11):

(1) the coating provides the shaped wire stem with controlled, resilient characteristics; and

(2) significantly augments the anchoring (bonding) of the wire stem to the terminal.

As used in the specification, one or more stems define a "skeleton".

An important feature of the invention is that, although wirebonding equipment is employed, it is generally employed in an unconventional (non-traditional) manner to provide an unconventional contact structure.

Conventionally, wirebonding equipment is used to bond an end of a wire, then bond and sever another end of the wire to make an electrical connection between two points.

According to the present invention, wirebonding equipment is used to fabricate free-standing straight stems (see, e.g., **Figures 7a, 7b, 7c, 8, 9, 10, 11, 12, 13, 18, 19, 20**), or to fabricate three-dimensionally shaped, free-standing stems (see, e.g., **Figures 14, 15, 16, 21**), or to fabricate "fence" structures (see, e.g., **Figures 17**). Moreover, multiple free-standing straight (see, e.g., **Figures 9, 10, 11, 12, 13, 19, 20**) or shaped (see, e.g., **Figure 5**) stems can be applied to a single terminal or an electronic component.

According to an aspect of the invention, free-standing single or multiple wire stems can be produced. (See, e.g., Specification at page 12, lines 10-11)

Generally, throughout the claims, a "skeleton" can be a "free standing single or multiple wire stems" (see, e.g., Specification, at page 12, line 10). In many instances, however, the skeleton comprises at least two wire stems (see, e.g., Specification at page 23, lines 3-4 ("With the method of the present invention, a plurality of wire stems can be employed to create a wire skeleton.").

Many of the embodiments disclosed and claimed herein are directed to free-standing, shaped wire stems. It should be noted, however, that the "second end" of the wire stem can also be bonded to form a shaped loop, which is also generally considered to be a skeleton, but would not be a "free standing" embodiment, since it has both (rather than only one) end bonded to the electronic component. However, bonding the second end of the wire stem to a sacrificial member, then removing the sacrificial member, would

result in a "free standing" embodiment.

According to an aspect of the invention, a wire stem can originate and terminate on the same terminal. (See, e.g., Specification at page 12, lines 16-17)

According to an aspect of the invention, a wire stem can originate on a terminal and terminate on a sacrificial conductor which can ultimately be eliminated. (See, e.g., Specification at page 12, lines 17-20)

According to an aspect of the invention, an array of protuberant straight contacts can be produced as pin-shaped contacts for ceramic pin grid array semiconductor packages or for plastic pin-carrying substrates. (See, e.g., Specification at page 13, lines 4-20, and at page 14, lines 1-2) In use as package pins, the stems are advantageously overcoated with nickel, copper, cobalt, iron, or allows thereof. (See e.g., Specification at page 13, line 19 through page 14, line 2)

According to an aspect of the invention, high aspect ratio solder contacts of controlled geometry can be provided on electronic components. In such solder contacts, the wire stem acts as a skeleton defining the final shape and aspect ratio of the solder contact, and solder is applied to the skeleton. This arrangement permits multiple reflows of the solder contact without loss of its controlled geometry. (See, e.g., Specification at page 14, lines 3-11)

According to an aspect of the invention, contacts may be formed by the disclosed process in various patterns, including arrays, on an electronic component. (See, e.g., Specification at page 14, lines 12-15)

According to an aspect of the invention, contacts formed by

the disclosed process are caused to be resilient, the resiliency of the contact being controlled (primarily) by the characteristics (thickness, yield strength, elastic modulus) of the coating(s) applied over the wire stem. (See, e.g., Specification at page 14, lines 12-19) Generally, a gold wire stem will exhibit poor resiliency, due to its relatively low yield strength, and a coating (overcoat) of nickel (e.g.) will impart resiliency to the contact.

According to an aspect of the invention, the contacts of the present invention can be applied to a plurality of locations (e.g., terminals) on an electronic component, and said locations may be of different height (vertical coordinates). Moreover, the free-ends (uppermost points) of the protuberant contacts can be caused to lie in a single plane (substantially identical vertical coordinates). Additionally, a portion of the protuberant contacts can terminate in one plane, while another portion of the protuberant contacts terminate in another plane - thereby allowing an electronic component having protuberant contacts to overlie single or multiple electronic devices including passive devices such as capacitors or resistors. (see, e.g., Specification at page 14, line 20 through page 15, line 20; also page 30, line 24 through page 31, line 1).

ARGUMENTS TRAVERSING THE SUBSTANTIVE GROUNDS OF REJECTION

Kobayashi, et al. is alleged by the examiner to teach the invention substantially as claimed. The examiner admits, however, that Kobayashi, et al. does not teach "the details of forming and bonding the individual sections of wire." Christy, et al. is cited in this rejection as teaching a method by which "individual sections of wire may be formed, bonded and severed", and "allows a wire segment to be broken immediately adjacent to a bond area." The examiner takes official notice of the "equivalence of melting and shearing as means of severing a bonded wire."

Kobayashi, et al. is directed to enhancing "damp-proofness" (e.g. moisture resistance and consequent corrosion resistance) of a resin-packaged (relatively dampness-prone) semiconductor device having a copper wire (3, e.g. bond wire) connecting (e.g., bridging) an aluminum electrode (5, e.g. bond pad) on a silicon chip (1, e.g. die) to a silver electrode (4, e.g. finger) on a lead frame (2).

Kobayashi, et al. achieves its stated objects by immersing the connected structure in a solution of benzotriazole ("BTA") in ethyl alcohol, thereby forming an Ag-BTA film on the leadframe finger (4), a Cu-BTA film on the bond wire (3), and an Al-BTA film on the bond pad (5), each of which films is a metal-organic film.

Each of Kobayashi, et al.'s metal-organic films serve simply (solely) as a protective layer inhibiting moisture intrusion and do not, and clearly are not intended to, modify the physical (e.g., resiliency) characteristics of the bond wire (3).

Whether or not Kobayashi's metal-BTA coatings conduct electricity appears to be incidental, since the wire is bonded prior to immersing in the BTA solution.

As is clearly seen in the figures, and as described in the text of Kobayashi, et al., the bonding of the die (1) to the leadframe fingers is performed in a straightforward, conventional manner of bonding a wire from "Point A" on the die to "Point B" on the leadframe, using copper wire for wire bonding.

As is evident, Kobayashi's protective (metal-BTA) coating is necessitated by copper's propensity to corrode, and serves principally to provide for protection against such corrosion.

Kobayashi's wire-coating technique is not directed at imparting resilient characteristics to an otherwise non-resilient wire (such as gold). Moreover, in many of the embodiments described in the specification of the present application, the wires (shaped wire stems) are free-standing (bonded at one end only).

In Kobayashi, et al., the metal-organic protective layer extends over the entire length of the wire (3), over the bond pad (5), and over an inner portion of the leadframe finger (4). However, as noted above, the metal-BTA coating is not continuous, and changes "chemistry" depending on the underlying metal (which is different for each of the bond sites and along the length of the wire).

In Figure 1C of Kobayashi, et al., it is evident that the bonded end of the bond wire (3), and the bond itself, encompasses an area less than the entire area of the bond pad (5). This is indicative of conventional wirebonding techniques. In conventional wirebonding techniques, the bond itself, whether ball or wedge, encompasses an area less than the entire are of the bond pad to which a bond wire is bonded. This results a joint (bond) of limited structural integrity, depending solely on the bond itself for structural integrity. Of course, limited structural integrity is not much of a problem when it is specifically intended that the

"other" end of the wire will also be bonded, and the wire is not expected to react forces in a resilient manner.

Reacting forces is the **raison d'être** of a free-standing, shaped, overcoated to be resilient, wire stem, such as described in the present application, and providing robust anchoring for the bonded end of the free-standing wire stem is obligatory. It is neither suggested by, or implicit in Kobayashi that a metal-BTA coating will enhance anchoring of a wire, not to mention a free-standing wire stem.

According to the present invention, a wire is bonded at one end to an electronic component, configured (in several of the embodiments) to have a shape suitable as a "precursor" of a resilient contact structure, and is overcoated with a conductive metallic material that imparts resilient properties to the resulting free-standing (in several of the embodiments) contact structure. The conductive material advertently (intentionally) encompasses a greater area of the bond pad (for example) than the ball or wedge formed on the bond pad by bonding the end of the bond wire thereto. This overcoating is selected for its "springiness", so that the resulting contact structure will be resilient, and encompasses the entire terminal (e.g.) to which the free-standing wire stem is bonded to ensure structural integrity of the contact structure in the presence of deflective forces (e.g., bending moments) applied thereto.

As shown, for example, in **Figure 2** of the present invention, a continuous coating 40 "anchors" the skeleton (wire stem) to the terminal (e.g., bond pad). The overcoating material (40) may be stronger than the material of the wire stem (30) and, in any case encompasses at least the entire bond pad (90). This **greatly enhances** the strength of the connection (bond) between the wire stem and the bond pad. (see, e.g., Specification at page 21, line 12 through page 22, line 9).

Kobayashi, et al. fails completely to teach or to suggest these critical features of the present invention in several respects.

Firstly, Kobayashi, et al.'s metal-BTA films are not "continuous". As shown in Figures 1C and 1D of Kobayashi, et al., an Al-BTA film encompasses an area of the bond pad (5) outside of the ball bond formed by the end of the bond wire (3), and a Cu-BTA film encompasses the bond wire itself (and a portion of the ball bond). A similar situation is seen in Figures 1B and 1E of Kobayashi, et al., wherein the bond wire (3) is bonded to a finger of a leadframe (i.e., to an electrode 4 disposed on the leadframe finger).

The metal-BTA protective films of Kobayashi, et al. are **discontinuous** (i.e, not the same on the bond pads and on the bond wire), and do not substantially enhance the structural integrity of the bond.

Moreover, in the context of overcoating a springy structure, and the coating providing the principal force-reacting mechanism, the discontinuities inherent in a discontinuous coating would be exactly what you would not want. In this regard, Kobayashi clearly teaches away from the present invention.

Although the present invention has been contrasted with Kobayashi, et al. in terms of "bond wire", "ball bonds", "bond pads", and the like, it should be understood that the specification and claims of the present invention set forth broader utility of the techniques of the present invention.

Before looking at the contribution of Christy, et al., it is important to note that a key element of the present invention is the formation of resilient contact structures, for example, from

a shaped skeleton (wire stem) of gold which is inherently non-resilient (gold deforms in response to applied forces) and an overcoating of a resilient material (e.g., nickel). The combination of material properties and shape impart the sought-after resilience to the resultant contact structure.

Kobayashi, et al. discusses coating a copper wire. It is relevant to note that, if Kobayashi, et al. were using gold bonding wire, on gold bond pads, with gold metallization on the lead frame fingers, there would be no pressing need for Kobayashi, et al. to use a coating of BTA. Simply stated, gold does not "rust" and is inherently "dampproof". Although it is doubtful whether gold would combine with BTA, BTA over gold would not impart the resilient properties of a contact structure sought after in the present invention. It is, in fact, the plasticity of gold that makes it an ideal material for the skeleton of the present invention. The teachings of the present invention dictate the use of an overcoat (e.g., nickel), not to protect against corrosion (e.g., when using a gold wire skeleton), but to impart the desired resiliency to the resulting contact structure. Herein lies a fundamental difference between the present invention and Kobayashi, et al. - namely, that the present invention is specifically directed to establishing the mechanical and physical characteristics of the resulting contact structures. In light of this fact, protection against corrosion is of attenuated relevance. (A notable exception is the use of a barrier layer as one of the layers of the coating, such as between a gold wire and a tin-containing solder overcoat, as discussed in the specification.)

The present invention cannot be "learned" from Kobayashi, et al., which is devoid of any teaching of how an inherently non-resilient wire can **chemically** be treated (e.g., by electroless plating) to become a spring (i.e., resilient contact structure).

As mentioned hereinabove, an ancillary, but no less important

benefit of the overcoat of the present invention is that the overcoat greatly augments the anchoring of the wire to the terminal (e.g.), thereby increasing the bond strength at the base of the wire stem. Films, such as Kobayashi's BTA would not improve the strength of the bond at the base. By virtue of the fact that the present invention inherently results in a larger area of bonding by the coating than by the wire stem alone, the adhesion (anchoring and ability to withstand bending forces) of the resulting contact structure is greatly enhanced - a result which does not "flow" from Kobayashi, et al..

Unlike Kobayashi's "transitional" (i.e., discontinuous, from one compound to another compound to another compound) layer (metal-BTA), the coating of the present invention is purposefully continuous or "unistructural". The coating (for example nickel) is the same along the entire length of the wire stem, from bond end to tip. This would be of enormous importance, for example, in the case of a discontinuity in the wire stem itself. Such discontinuities would be stress points, which could (and likely would) result in fracture of the wire stem upon repeated loading and unloading. With the robust, continuous overcoat of the present invention, it would not matter, for virtually all intents and purposes, whether the wire stem were to fracture, since it is the coating that reacts (resiliently) the applied loads, and it the coating which makes electrical contact (except in certain jacketed embodiments) to external components, and it is the coating which carries at least a significant portion of the currents between the electronic component to which the resilient contact structures are mounted and an external component. Although not set forth with specificity in the specification (although it is fairly implied therein, and is not claimed herein), it is nevertheless relevant to note that the wire stem could be formed of any shapable, non-conductive material that can be overcoated - for example, a strand of spaghetti. It is the overcoating of the contact structure that imparts resiliency to the contact structure and which reacts

applied loads, and it is the coating that "bridges" the terminal (e.g.) and the external component. Inasmuch as it is the coating (or the top layer of a multi-layer coating) which makes contact with another (external) electronic component, it is generally immaterial whether the wire itself is conductive.

In summary, the resilient contact structure of the present invention derives its resiliency and strength from its overcoat, which also serves to better anchor the wire stem to the terminal (e.g.).

As mentioned above, the "secondary" reference Christy, et al. is cited by the examiner as teaching a method by which "individual sections of wire may be formed, bonded and severed", and "allows a wire segment to be broken immediately adjacent to a bond area." The examiner takes official notice of the "equivalence of melting and shearing as means of severing a bonded wire."

Christy, et al. is illustrative of "conventional" wirebonding techniques, wherein wire is supplied through a needle (capillary), a first bond is made, the needle (and/or the component) is moved, and a second bond is made. Generally, in a traditional wire bonding operation, the wire "arches" between the first bond and the second bond. Although an arch is a "shape", it is not free-standing (anchored at only one end).

Christy, et al. further describes techniques for severing the wire, **at the bonding area.** Previous techniques such as clamping and pulling the wire, for breaking the wire at the bonding area (column 1, lines 27-29), and such as using a scissors type of operation for cutting the wire **immediately adjacent the bond area** (column 1, lines 29-32).

The severing technique disclosed by Christy, et al. is illustrated in Figures 3-5 therein, wherein the needle bonds the

wire (Figure 3), then elevates vertically (Figure 4), then moves over laterally and comes down (Figure 5) to sever the wire against the shoulder of the bond pad (19). Figure 6 shows the severed wire.

This is all highly immaterial to an evaluation of the present invention, although the usefulness of Christy, et al. as a reference generally showing wirebonding for combining with the teachings of Kobayashi, et al. (wherein wire bonding is assumed to be well known) is not disputed.

The immateriality and irrelevance of Christy, et al. resides principally in the fact that it is addressing breaking off a second bonded end of a wire at (or immediately adjacent to) a second bond site.

With reference to **Figures 7a, 7b and 7c** of the present invention, it is clearly seen that the present invention contemplates performing a cutting-off operation on a bond wire at other than the bond site - namely, in free space - to create a free-standing wire stem.

Vis-a-vis "forming" the wire, Christy, et al. is entirely inapposite and antithetical to the teachings of the present invention. Note, in Christy, et al.:

> "... moving the bonding needle with holding pressure sufficient to frictionally engage the wire and **insufficient to deform the wire ...**" (column 1, lines 13-15; Emphasis added)
>
> "The needle then forcefully holds the wire by a force **insufficient to deform such wire ...**" (column 1, lines 42-26; Emphasis added)

As mentioned hereinabove, the examiner takes "official notice" of the "equivalence of melting and shearing as means of severing a bonded wire." Assuming arguendo that these techniques are

equivalent, as used to support the grounds of rejection, the proposition (of equivalence) is still immaterial and irrelevant.

Notwithstanding the above, applicant asserts that melting and shearing are <u>not</u> equivalent, as applied to the techniques of the present invention. In **Figure 7b**, for example, there is shown an electrode 3 which "is brought under a high potential, resulting in a generation of a spark which melts and severs the wire 20" at a location which is most assuredly not at (or, for that matter adjacent to) the bond pad (90, "terminal"). (see e.g., Specification at page 28, lines 3-10). Such melting of the wire results in a ball being formed at the severed end (25) of the wire stem (62). Shearing would, intuitively, not result in such formation of a ball at the (top) end of the wire (62). Applicant having overcome the presumption set forth by the examiner (i.e., of the equivalence of shearing and melting), it is respectfully requested by the applicant that the examiner present relevant, documentary evidence of this proposition if the argument is further to be pursued.

As mentioned above, conventional wirebonding can be construed as imparting a "shape" to a wire - the shape typically being that of an arch. It is well known that the "shape" assumed by a wire in conventional wirebonding is more-or-less incidental, the principal concern in conventional wirebonding being to minimize the arch to avoid wire-sweep (shorting of one bond wire to another bond wire). A small amount of "slack", resulting in the arch, is often required to allow for differences in thermal coefficient of expansion between the two components (e.g., a semiconductor die and a leadframe) which are wirebonded to one another.

The shape of the free-standing wire stems of the present invention are, most assuredly, not incidental. First of all, a material such as gold, which is readily formable into a desired shape is selected. The formability of the wire is an indication

of its inability to function as a spring. Thus, the shaped wire (wire stem) is overcoated with one or more layers of a material which are well-suited to functioning as a spring (and which tend not to be readily formable).

Returning to the comments regarding Kobayashi, et al. set forth above, the principal feature of the invention is in overcoating a stem (or skeleton) to imbue it with resiliency. In this light, it is immaterial how the stem is severed, although certain techniques are preferred (e.g., such as for ensuring precise vertical positions, and in many cases coplanarity, of the tips of the stems).

The remaining references cited in the Office action have been reviewed by the applicant, but are believed to be no more material to an evaluation of the invention than the references discussed hereinabove, these remaining references being, at best, merely cumulative of the references discussed hereinabove.

For example, Jackson (5,097,100) discloses a noble metal plated wire and terminal assembly. A wire (12) having a copper (or silver, or aluminum) core (24) is coated with gold (noble metal, including ruthenium, rhodium, rhodium, palladium, osmium, iridium, platinum, and combinations thereof) layers (26, 28), and is insulated (30). The insulation is stripped off the end (16) of the wire, and the wire is welded to a noble metal terminal (18) atop a noble metal layer (19). In this manner, there is a gold-to-gold (galvanically compatible) connection made between the wire (i.e., the coating of the wire) and the terminal which will not corrode. (The limited invasion of corrosion via the exposed end of the copper core is discussed.) The teachings of this reference are limited to avoiding corrosion. Moreover, as stated in this reference (column 5, lines 14-16):

> "The joint is welded rather than soldered to avoid adding an indeterminate amount of another metal to the joint."

In this regard, Jackson teaches directly away from the present invention, wherein the coating provided over the wire stem is selected for its spring qualities, irrespective of the material of the terminal.

Copies of number of additional references, which came to the applicant's attention subsequent to the filing of this patent application, are provided herewith. However, these references do not anticipate, nor do they render obvious, the claimed invention. For example:

One recent effort directed to making resilient connections is described in an article entitled ELASTOMERIC CONNECTOR FOR MCM AND TEST APPLICATIONS, ICEMM Proceedings, 1993, pages 341-346, which describes an "Elasticon" (tm) connector. The Elasticon connector uses solid gold or gold alloy wires for the conductive elements, embedded in an elastomer material (e.g., liquid elastomer resin injected into a mold cavity), and is generally targeted at the interconnection requirements for land grid array (LGA) packages for multichip (MCM) and single (SCM) chip modules. The size, shape and spacing of the wires, along with the elastomer material properties, can be tailored to specific application requirements which include MCM and SCM packaging, board-to-board and cable-to-board interconnections, as well as high density PCB and IC chip testing applications. The solid gold wires and the silicone elastomer material are impervious to corrosion. Figure 1 of the article illustrates a basic embodiment of the Elasticon connector, wherein a plurality of wires are ball-bonded to a rigid substrate and extend straight at an angle (e.g., 45-85°) from the surface of the substrate. Attachment of the proximal ends of the wires to the substrate is by an angled flying lead wire bonding process using compressive force and ultrasonic energy applied through the capillary tip and thermal energy applied through the heated stage on the wirebonder. The capillary and substrate are positioned to allow a shear blade mechanism to sever the wire at the desired

height and angle from the substrate surface. Electronic flame-off (EFO) is used to melt the wire extending from the capillary tip to start the next ball bond (of the proximal end of the next wire to be bonded to the substrate). After mounting all of the wires to the substrate, a ball-shaped contact is formed at the far (distal) end of each wire by a process of laser ball forming, and the plurality of wires are embedded in an elastomer material. The ball-shaped (enlarged) distal ends help prevent the wires from vibrating loose and causing shorts between contacts. As noted in the article, the angled orientation of the conductors is necessary to minimize plastic deformation of the wires as an Elasticon connector is compressed between two parallel surfaces. The angled orientation also provides a "wiping" contact surface which, when the connector is compressed, will cause the wires to rotate and slide against the mating contact surfaces. The article discusses the use of gold/palladium alloys and platinum for the wires. Copper is also mentioned but, as discussed, would need to be plated with Ni/Au to prevent corrosion. Figure 3 of the article describes clustering wires in groups of one to four wires per contact, in conjunction with forming grooves in the elastomer between each group of wires. The various embodiments of the Elasticon connector described in the article require a substrate of ceramic, metal, silicon or epoxy-glass laminate material, and interposer embodiments require an etchable substrate material such as copper with a thin layer of gold on the top surface. Figure 8 of the article describes integrated probe contacts and aptly notes that the ability to test for known good dies has been one of the stumbling blocks for MCM packaging. As shown therein, a probe matrix uses 2 mil (0.002 inch) diameter gold wires in an array. The probes can permanently be attached to the test module, or fabricated as an interposer structure. **None of the embodiments described in this article are directed to a method of making a contact structure by forming a wire stem and overcoating the stem with a metallic, conductive material, especially with an overcoating material which is resilient as well as conductive.**

U.S. Patent No. 5,067,007 (Kanji, et al.; 19 Nov 91; USCL 357/54), entitled SEMICONDUCTOR DEVICE HAVING LEADS FOR MOUNTING TO A SURFACE OF A PRINTED CIRCUIT BOARD, discloses improving the reliability of surface-mount type packages so that when the packages are mounted to a wiring substrate, the lead pins that receive load from the axial direction exhibit bending strength which is smaller than the junction strength at the junction portions. To achieve this object, the lead pins are made of a material having large resiliency such as fiber-reinforced material, a transformation pseudo-elastic material, an ultra-high tension material, or a heat-resistant ultra-high tension material. This patent also points out the problem that, in the case of pin grid array (PGA) packages, all of the pins are not necessarily of the same length - the result of which is that some of the pins may not contact pads (e.g., on a test substrate). Figures 7A and 7B of this patent are of particular interest, wherein pins (20) have a particular shape and are formed of a particular material. The pins (20) are made of a material having Young's modulus of smaller than 15×10^{10} Pa, and have their central portions curved in an arcuate form such that the displacement from the axial (straight) direction becomes greater than one half the diameter of the pins. Examples of materials satisfying the Young's modulus criteria are: highly pure copper (Cu), highly pure iron (Fe), highly pure nickel (Ni), copper alloy, and a composite wire comprising of a stringly (sic) resilient fine wire bundled with a soft metal such as copper as a binding material. With such a shape, and being formed of such materials, the deformation strength (yield strength) of the pins becomes smaller than the junction strength of either the brazing material (12, holding the pin to the package) or the solder (13, connecting the pin to the PCB). When thermal or mechanical stresses are exerted on the pins, they undergo elastic deformation to reduce the stress. In an exemplary embodiment shown in Figure 1D and described with respect thereto, tungsten (W) molybdenum, carbon amorphous metal and fine wires having large resiliency are

described. The fine wire may be a composite wire (11A) which is bundled together with a soft metal such as copper as the binding material. The composite wire has a plating (11B) which comprises gold (Au) or gold/nickel. Gold, as discussed hereinabove, is very soft, and inherently not resilient. As specifically mentioned in this patent, "the thickness of the plating is so small that the effect to the bending strength [of the composite wire 11A] can be neglected. The plating is effected for the purpose of easy soldering and, concretely (sic), has a thickness of 1 to 4 μm for nickel and 0.1 to 1 μm for gold." (see paragraph bridging columns 7-8). **This patent reference "teaches away" from the present invention, wherein the physical characteristic of the plating ("metallic conductive material") are precisely what gives the contact structures their resiliency (in addition to greatly augmenting the anchoring of the wire stem). Moreover, the overcoat of the present invention performs the additional function of securely anchoring the wire stem to the electronic component. (Contrast this to the above, wherein the patent reference teaches that the deformation strength (yield strength) of the pins becomes smaller than the junction strength of either the brazing material or the solder.)**

U.S. Patent No. 5,086,337 (Noro, et al., 4 Feb 92; USCL 357/79), entitled CONNECTING STRUCTURE OF ELECTRONIC PART AND ELECTRONIC DEVICE USING THE STRUCTURE, discusses the desirability of having deformability (freedom) and flexibility (spring property) in a perpendicular (z) direction at the junctions between LSI chips (semiconductor dies having Large Scale Integration) and a wiring substrate. (see, e.g., column 4, lines 50-55). This patent discloses a connecting structure for electrically connecting an electronic part, such as an LSI chip, to a substrate, such as a wiring substrate, having an absorption function of the difference of thermal expansion in a horizontal direction (e.g., in the plane of the chip) and capability of displacement in a vertical (z-axis) direction. A representative embodiment of the connecting structure

is shown in Figures 2(a), 2(b) and 2(c), wherein the connecting structure is in the form of a **flat, spiral spring**, a one end of the flat spiral spring being connected to a one electronic component, and another end of the flat spiral spring is connected to another electronic component. This allows for displacement of the two components in the z-axis, while maintaining a connection therebetween. The flat, spiral spring connectors are generally formed as a Cr-Cu-Cr "sandwich", which is annealed and coated with Au to improve its solder-wettability (Cr being comparatively non-wettable as compared with Au). **Flat spiral springs teach away from the present invention.**

U.S. Patent No. 4,989,069 (Hawkins; 29 Jan 91; USCL 357/74), entitled SEMICONDUCTOR PACKAGE HAVING LEADS THAT BREAK-AWAY FROM SUPPORTS, discloses a stress buffer frame (16) having flexible metal leads (26) reducing stress caused by the differing coefficients of thermal expansion of a semiconductor package and a printed circuit or the like on which the package is mounted. The leads are essentially flat ribbon-like leads, which are bent to extend away from the buffer frame, then bent again to have a portion (32) parallel to the buffer frame. Nickel/iron alloy is discussed as a material for the frame (and leads thereof). **The flat, ribbon-like leads of this reference, formed of nickel/iron alloy which is resilient, teaches away from the present invention.**

U.S. Patent No. 3,616,532 (Beck; 2 Nov 71; USCL 174/68.5), entitled MULTILAYER PRINTED CIRCUIT ELECTRICAL INTERCONNECTION DEVICE, discloses an interconnection arrangement similar to Dube, et al., (U.S. Patent No. 3,509,270, previously disclosed), wherein coil springs are compressed and inserted into a pot of molten solder, and subsequently withdrawn from the pot and the solder allowed to solidify to thereby hold the coils of the compression spring tightly together against the restoring force of the spring. These compressed springs are then inserted into apertures of an interposer-layer 24 which is disposed between two printed circuit

boards (10, 12). The assembly (board, interposer with precompressed springs, board) is the heated such that the solder holding the coils of the springs again liquifies and releases the spring tension. The springs are therefore permitted to expand and to establish contact between the abutting printed circuit levels (boards). **This reference teaches away from the present invention by suggesting that it is necessary to maintain coil spring contacts in a state of compression, to be "released" upon heating (e.g., soldering).**

<u>U.S. Patent No. 4,705,205 (Allen, et al.; 10 Nov 87; USCL 228/180)</u>, entitled CHIP CARRIER MOUNTING DEVICE describes an "interconnection preform placement device" (also known as an "interposer"). In Figures 11A-11C, 12 and 13 of the patent there are described a variety of solder "preforms" which have S-shapes (Figures 11A, 11B, 11C) or C-shapes (Figure 12), or a coiled spring configuration (Figure 13). The preforms are disposed in apertures (holes) through support ("holder", "retaining") layers (e.g., 50 and 52 in Figure 11A). The C-shaped preform is disposed around the edge of a support layer. The preforms are a "filled solder composition" (a solder material which contains a filler of discrete particles or filaments) or a "supported solder" (solder supported by a support strand or tape which is disposed about the outside of the solder preform shape), which will retain its shape upon the solder melting or reflowing. For example, the particles in a filled solder composition should have a melting point above the melting point of the solder. Filler materials such as copper, nickel, iron, and metal-coated high-temperature polymer or glass films are disclosed and, as mentioned, can be in the form of discrete particles (e.g., powders) or continuous lengths with a single strand or many strands in each preform.

The aforementioned techniques fail to disclose or suggest the contact structures of the present invention. By way of example, gold would appear to be the material of choice for making

electrical connections. However, although gold exhibits excellent electrical conductivity, it suffers from certain shortcomings, as relevant to the present invention. For example, gold has a very low yield strength, a characteristic which makes it counter-intuitive to employ a gold wire as the basis of a resilient contact structure. Simply stated, when physically stressed, gold (e.g., a gold wire) will tend to deform, and to retain its deformed configuration. In many of the embodiments of the present invention, a deformable wire such as gold is used, and is then overcoated with a "springy" conductive metallic material, to achieve a resilient contact structure. Another "shortcoming" of using gold wires as an interconnect medium is gold's propensity to react adversely with solder - namely with the tin content of common lead-tin solder. Certain embodiments of the present invention require a barrier layer, when a gold wire is overcoated with tin-containing solder.

A patent examiner bears the burden of establishing a prima facie case of obviousness when rejecting claims under 35 USC §103. The mere fact that the references cited by the examiner may be modified does not allow the examiner to meet his or her burden absent a suggestion in the cited art of the desirability of the modification. Moreover, the examiner may not "use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." In re Fritch, 23 USPQ 2d 1780 (Fed. Cir. 1992).

In the discussion presented above, references have been made to text in the references, by column and line number. In certain instances, due to the vagaries of printing, it is difficult to ascertain the exact line number of a line of text. Hence, references to same should not be interpreted as limiting in character. Similarly, references to pages and lines of the Specification of the present patent application should not be construed as limiting, but rather are intended to be used as

exemplary, to facilitate following the arguments presented herein.

NEWLY-PRESENTED CLAIMS

The newly-presented claims generally fall into one of two "categories", as follows:

CATEGORY-1: Claims **39-158** are "derived" from claims 1-38, as filed. For example, certain claims which were filed as multiple dependent claims are split apart into a plurality of claims. Additionally, subject matter disclosed in the specification, but not previously claimed, is presented in these claims. A claims chart follows, which will aid the examiner in "tracking" the claims. It will be noted, that in this amendment, a number of claims were amended to depend directly from claim 15, which previously was determined to be allowable.

CATEGORY-2: Claims **159-275** are "new claims". Support is found in the specification as set forth below. Again, this is intended solely as an aid for examining the claims.

CLAIM CHART

This "claim chart" is intended solely as a "logistical" aid, and is not intended to be construed as limiting the scope of the claims. Claims 1-38, **as amended herewith**, are referenced by their "old #" (i.e., original claim number). The format is X-A, where X is the claim number and A is the claim (or claims A,B,C,D,E) from which the claim X (or the claims X..Y) depends.

old #	new claim #s	topic covered
IND 1		electronic component, enveloping
2-1		bonding second end to component
IND 3		electronic component, jacketing
4-1	39-3	$\geq$ 1 stems = skeleton
5-4	40-39	bonding second end to component

IND 6		terminal, enveloping
7-6	41-3	bonding second end to terminal
8-6	42-3	≥ 1 stems = skeleton
9-8	43-3, 44-7	bonding second end to terminal
IND 10		terminal, jacketing
11-10		bonding second end to terminal
12-10		≥ 1 stems = skeleton
13-12		bonding second end to terminal
IND 14		terminal, enveloping
IND 15	IND 50..53	terminal, enveloping, sacrificial member
16-15		severing from sacrificial member
17-15	(54..57)-(1,3,6,14)	on a plurality of terminals
18-15	58-17, 59-6	on a plurality of wires
19-15	n/a	pressure, temperature, ultrasonic
20-15	60-6	sever by melting
21-15	n/a	shaping with an external tool
22-15	61-6	sever by mechanical shearing
23-15	n/a	shaping with the wirebonder
24-15	(62..67)-(1,2,3,4,6,8)	shape and mechanical properties
IND 25	(68..72)-(1,2,3,4,6)	microprotrusions
26-15	(73..80)-(1,2,3,4,6,8,15,17)	multi-layer coating
IND 27	(81..86)-(1,2,3,4,6,8)	shape and mechanical properties multi-layer coating
28-27	(87..92)-(1,2,3,4,6,8)	jagged topography
29-15	93-17, 94-24 (95..100)-(1,2,3,4,6,8)	electrochemical plating

	(101..105)-(1,3,6,10,15)	electroless plating
	(106..110)-(1,3,6,10,15)	internal stress
IND 30	111-8	severing in a common plane
31-30	112-111	terminals in different planes
32-6	113-8	shape and mechanical properties severing in a common plane
33 (cancelled)	114-1, 115-15	rectangular cross-section
34-1	(116..119)-(3,6,10,15)	wire and coating materials
	(120..125)-(1,3,6,10,14,15)	wire materials only
	(125..130)-(1,3,6,10,15)	coating materials only
35-14	(131..139)-(1,2,3,4,6,8,10,14,15)	intermediate layer solder top layer
36-15	(140..146)-(1,6,8,17,24,26,27)	barrier layer
37-36	n/a	
38 (cancelled)	(147..152)-(1,3,6,10,14,15)	each of two surfaces has ≥ 1 contact

It will be noted that certain of the newly-presented claims are omitted from the listing presented hereinabove. Generally, this is because there was no "old" claim to point to. However, support for these claims (including certain ones of the claims listed above) is found in the specification, as follows:

Newly-presented claims 45-49 are supported, for example, in the specification at the paragraph spanning pages 35-36.

Newly-presented claim 68-72 are similar to claim 25, in that they include a "microprotrusions" limitation, but depend from

claims 1,2,3,4 and 6, respectively. Support can be found in the specification, for example, at the paragraph spanning pages 34-35.

Newly-presented claims 73-80 are similar to claim 26, but depend from claims 1, 2, 3, 4, 6, 8, 15 and 17, respectively. Support can be found in the specification, for example at the sentence bridging pages 24-25.

Newly-presented claims 106-110 are directed to another (than the specific coating technique employed) parameter associated with deposition of the conductive material, and depend from claims 1, 3, 6, 10 and 15, respectively. Support can be found in the specification, for example, at page 22, lines 5-9.

Newly-presented claims 153-158 recite particular shapes for the wire stem, and depend from independent claims 1, 3, 6, 10, 14 and 15, respectively. Support can be found, for example, in the specification at page 33, lines 6-12.

Newly-presented independent claim 159 includes limitations recommended by the examiner at the 2/7/95 interview - notably (emphasis supplied):

> "configuring the wire to have a shape including **at least two bends**"
>
> "overcoating the wire and an area surrounding the bonded end of the wire with an electrically conductive, **metallic** material"

Newly-presented independent claim 160 commences a new set of claims, support for which can be found, as follows.

Support for <u>Claims 161-172</u> can be found in the Specification, for example:

- at page 11, lines 13-15 ("envelops" to covers the entire

length, or "jackets" to cover only a portion thereof);

- at Figure 8 (at least one layer deposited along the entire length);
- at page 19, lines 13-19 (the fact that wirebonding machines supply wire from a spool is well known);
- at the sentence bridging pages 19-20 (terminal);
- at Figure 2 for an illustration of a wire stem formed in two dimensions;
- at page 12, lines 10-14 (extends normal, or at an angle);
- at page 11, lines 9-13 (shaped in three-dimensions); and
- at page 33, lines 11-12 (S-shape).

Support for Claims 173-181 can be found in the Specification, for example, at page 11, lines 19-21 and at page 36, lines 3-17.

Support for Claims 182-184 can be found in the Specification, for example, at page 12, lines 3-6.

Support for Claims 185-187 can be found in the Specification, for example, at page 13, lines 10-14, and at page 15, lines 16-20.

Support for Claims 188-189 can be found in the Specification, for example, at page 27, line 18, through page 28, line 10.

Support for Claim 190 can be found in the Specification, for example, at **Figure 7b**.

Support for Claims 191-195 can be found in the specification, for example, at page 21, lines 19-23, and at page 22, lines 10-16.

Support for Claims 196-202 can be found in the Specification, for example, at Figure 16 and at page 34 line 16 through page 35, line 10.

Support for <u>Claim 203</u> can be found in the Specification, for example, at page 20, lines 19-26.

Support for <u>Claims 204-205</u> can be found in the Specification, for example, at page 25, lines 2-3.

Support for <u>Claim 206</u> can be found in the Specification, for example, at page 13, line 17 through page 14, line 2.

Support for <u>Claim 207</u> can be found in the Specification, for example, at page 22, lines 2-4.

Support for <u>Claim 208</u> can be found in the Specification, for example, at page 22, lines 5-9.

Support for <u>Claims 209-210</u> can be found in the Specification, for example, at page 25, lines 3-5.

Support for <u>Claims 211-213</u> can be found in the Specification, for example, at page 11, lines 2-7; and at page 11, lines 23-25; and at page 22, line 17 through page 23, line 2.

Support for <u>Claim 214</u> can be found in the Specification, for example, at the sentence bridging pages 20-21.

Support for <u>Claims 215-216</u> is inherent (fairly implied, and can be taken "notice" of), in light of the disclosure of the present invention, and would readily be ascertained by one having ordinary skill in the art to which the present invention most nearly pertains, in light of the teachings of the specification - namely with regard to techniques for fabricating and patterning top-level metal on a semiconductor device, wherein a continuous (blanket) layer of metal (a conductor) is deposited, is then patterned with photoresist to create distinct terminals (or pads),

and is finally selectively etched to leave the terminals (or pads) on the surface of the semiconductor. At the interview of 2/7/95, it was briefly discussed that these two claims may include "new matter". Applicant asserts that they do not.

Support for Claim 217 can be found in the Specification, for example, at page 14, lines 12-19.

Support for Claim 218 can be found in the Specification, for example, at page 21, lines 19-20.

Support for Claim 219 can be found in the Specification, for example, at page 11, lines 2-6.

Support for Claims 220-222 can be found in the Specification, for example, at page 13, line 17 through page 14, line 2.

Support for Claims 223-236 can be found in the Specification, for example, at page 14, line 20 through page 15, line 20; and at Figure 12; and at page 30, line 16 through page 31, line 7.

Support for Claims 237-239 can be found in the Specification, for example, at the sentence bridging pages 13-14, also at page 14, lines 3-11, and at page 22, lines 17-24.

Support for Claims 240-241 can be found in the Specification, for example, at page 11, lines 21-23.

Support for Claims 242-243 can be found in the Specification, for example, at page 24, line 23, through page 25, line 10.

Support for Claims 244-251 can be found in the Specification, for example, at page 12, lines 14-25.

Support for Claim 252 can be found in the Specification, for

example, at Figs. 3-5 and at page 23, line 21 to page 24, line 5.

Support for Claim 253, notably the language "intermediate portion" can be found in the specification, for example, at page 20, lines 6-14. Although the specification states "A second end of the wire stem is bonded", it is clear that (in general, to form a loop-type skeleton) it is an "intermediate portion" of the wire that is bonded:

> "A second end of the wire stem is bonded ... a wedge-shaped joint 23 is thereby produced ... The capillary then rises ... a clamp 2 closes, and the wire is severed ... leaving a fractured free end 24 (which becomes the first bonded end for the next protuberant contact/skeleton)".

Support for Claim 254 can be found in the Specification, for example, at page 20, lines 8-10:

> "A second end (see comments above, regarding "intermediate portion") of the wire stem is bonded to the terminal 90 (i.e., the same, second area on the surface of the electronic component) ..."

Support for Claim 255 can be found in the specification, for example, at page 23, lines 17-20.

> "in the following step [the wire skeletons] are overcoated by a solder mass."

Support for Claim 256 can be found in the Specification, for example, at page 23, lines 17-20.:

> "the wire skeletons 30 are first coated with an optional barrier layer 41, and in the following step are overcoated by a solder mass 42."

Support for Claims 258-260 can be found in the Specification, for example, at page 23, lines 3-6.

Support for Claims 261-265 can be found in the Specification, for example, at **Figure 17** and at page 35, line 17 through page 36,

line 2)

Support for Claims 266-267 can be found in the Specification, for example, at page 13, lines 4-10.

Dependent Claim 268 is generally directed to a loop (skeleton) formed in three-dimensions, rather than in two dimensions. For example, a wire stem can be extended upward in a +Z direction from the electronic component (in the X,Y plane), then in a +X direction, then further in the +Z direction, then in a + Y-direction, then back towards the electronic component in the -Z direction, then in the -X direction, finally in the -Z direction to terminate on the same area whereat it started. Support for claim 268 can be derived, and is at least fairly implied, for example, from the Specification at page 11, lines 3-4 ("process for production of precise shape and geometry protuberant contacts"), at page 11, lines 11-12) ("stems being shaped in three dimensional space, to define skeletons"), at page 21, lines 9-10 ("the skeleton 30 geometrically defines the protuberant contact produced by the method of the present invention."), and at page 21, lines 19-20 ("The overcoating material may be significantly stronger than the skeleton material.").

Independent Claim 269 incorporates the "metallic" limitation (distinguishing the present invention from Kobayashi, et al.), and further includes a limitation wherein the wire has "at least one U-shaped bend along its length".

Support for Claims 271-275 can be found in the Specification, for example, **Figures 20 and 21**, at page 27, lines 11-14, at page 36, lines 9-12, and at page 39, lines 1-24.

Independent Claim 276 is directed to employing resilient contacts on a first electronic component to make "temporary" connections to a second electronic component (such as a test board

or a burn-in fixture) then, subsequently using the same resilient contacts on the first electronic component to make permanent (e.g., solder) connections to a third electronic component (such as a printed circuit board in a system). Support for Claim 276 can be found in the Specification, for example, at page 39, lines 10-24.

Support for Claim 277 can be found in the Specification, for example, at page 27, lines 11-14.

Due to the size of this amendment (it is, admittedly larger than the case, as filed), it is not inconceivable that certain typographical errors will be present, despite every effort reasonable having been made to avoid same. In such a case, the examiner is requested to contact the newly-appointed attorney, by telephone, to make any clarifications thought to be necessary.

Moreover, in light of the excess claims fees paid herewith, it is specifically requested that the examiner issue a non-final second Office action if this amendment does not place substantially all of the claims in condition for allowance.

EXAMINER INTERVIEWS

An informal telephone interview was held with the examiner on 1/25/95, at which time the present invention and the art of record were generally discussed.

A formal interview was held with the applicant, the applicant's attorney, and the examiner on 2/7/95, at which time prototypes of the invention were displayed. The Kobayashi, et al. reference was discussed, particularly the fact that Kobayashi, et al. discloses a metal-organic compound coating, and not a metal-organic composite coating. It was generally agreed that the addition of the term "metallic" (i.e., "metallic conductive material") to the independent claims would place the case in condition for allowance, if it could be shown that Kobayashi, et al. is not a metal-organic composite coating.

The **AFFIDAVIT OF BENJAMIN N. ELDRIDGE** is enclosed herewith (copy of fax, original to follow under separate cover), which avers, inter alia, that Kobayashi, et al.:

- does not disclose a "metallic" coating; and
- discloses a compound (not a composite).

In light of these averments, and the amendment to the independent claims to clarify that the applicant's coating is "metallic", and is "conductive" (as filed), the claims should be allowed.

It was further discussed at the interview that the examiner would react positively to a recitation of spring shapes in the claims. **Claims 153-158**, presented herewith, depending from independent claims 1, 3, 6, 10, 14 and 15, recite an "S-shape" which, when overcoated with a metallic conductive material will impart resiliency to the claimed protuberant conductive contact.

Fee Calculation:

The case was filed with claims numbered 1-38. There were twelve multiple dependent claims (17, 24, 29-38) presented with the application, referring to a total of 37 claims, the difference (37-12) being 25. However, six of these multiple dependent claims (29, 33, 34, 36-38) were withdrawn from consideration as being in improper form, and are counted as ONE (each). The remaining six multiple dependent claims (17, 24, 30-32, 35) referred to a total of 21 claims. 21-6 = 15 excess claims. 15+38 = 53 total claims.

It would appear that **six independent, and fifty-three total claims have previously been paid for.**

There are no multiple dependent claims remaining after this amendment.

In this amendment, there are **19** independent claims (of which 6 were previously paid for), and **275** total claims (of which 53 were previously paid for), or:

13 excess independent claims @ $38 each; and

222 excess total claims @ $11 each

The amount of **$ 2,936** (13 x 38, plus 222 x 11) is enclosed herewith.

AMENDMENTS TO THE SPECIFICATION

For the most part, the amendments to the text of the specification are clerical in nature, and would be obvious to the reader thereof.

A notable exception is the apparent lack of, and addition herewith of, an ABSTRACT, following the claims which end at page 50. Please bear in mind that the newly-appointed attorney of record "inherited" this case, and there was no abstract included in the materials made available. The language to be inserted is taken and edited from the specification to ensure that no new matter is added to the specification.

CONCLUSION

The claims should be allowed.

No new matter is entered by this amendment.

Various fees (set forth on the transmittal page) are enclosed herewith.

In light of the substantial fees for excess claims enclosed herewith, it is respectfully requested that the examiner, if disinclined to allow a majority of the claims presented herewith, contact applicant's attorney for a telephonic interview to discuss recommendations for further amendment of the claims to obtain their allowance.

For the applicant,

Gerald E. Linden   13 Feb 95

Gerald E. Linden 30,282   date

(407) 382-7966

c:\app\94-552.amd